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Economic Intelligence Report

DEVELOPMENT OF A PETROCHEMICAL INDUSTRY IN EASTERN EUROPE



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CENTRAL INTELLIGENCE AGENCY

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IN EASTERN EUROPE**

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DEVELOPMENT OF A PETROCHEMICAL INDUSTRY IN EASTERN EUROPE*

Summary

The plans formulated in 1958 for the expansion of the chemical industries of the European Satellites** provide for the establishment of a petrochemical*** industry in these countries as the most economical means of obtaining raw materials for the end products most stressed in the plans -- chiefly plastics, synthetic rubber, synthetic fibers, and fertilizers. Development of petrochemical production, in turn, will be made possible by sharply increased imports of Soviet oil to be delivered mostly by means of the highly publicized pipeline now being built from the Soviet oilfields to Poland, East Germany, Czechoslovakia, and Hungary.

Each of these four countries is building a large refinery and associated petrochemical facilities to process Soviet oil and also is building or expanding other plants utilizing petrochemical raw materials. Bulgaria is building a refinery and petrochemical complex to process Soviet oil obtained by sea. Rumania plans a widespread development of its petrochemical industry on the basis of indigenous resources, and Albania has scheduled one plant to use domestic oil or natural gas. As an indication of the importance of petrochemicals in the production plans of the Satellites, an amount equal to about 70 percent of the total increase planned for nitrogen fertilizer between 1960 and 1965 is to be produced from petrochemicals as well as more than 80 percent of the increment in production of synthetic rubber.

In all the Satellites, planned investments in the petrochemical industry represent a sizable share of total investments planned for the

* The estimates and conclusions in this report represent the best judgment of this Office as of 15 July 1962.

** Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Rumania. The term Satellites as used in this report refers to the European Satellites.

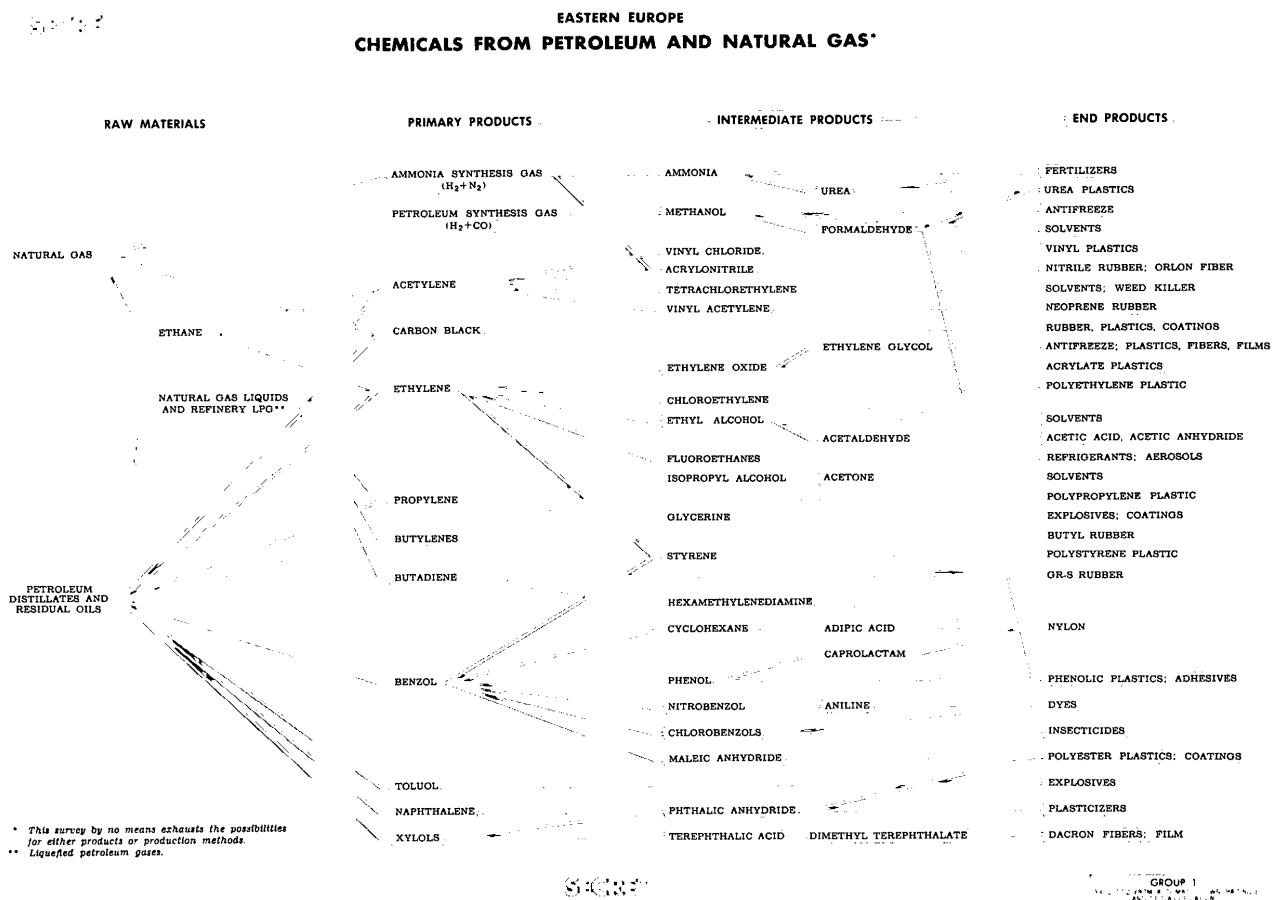
*** The term petrochemical, for which no universally accepted definition exists, is used in this report to refer to primary or basic chemicals obtained from petroleum or natural gas, including principally the olefins (mainly acetylene, ethylene, propylene, butylenes, and butadiene); the aromatics (chiefly benzol, toluol, xylols, and naphthalene); and one important inorganic chemical, ammonia. A more detailed survey of chemicals derived from petroleum and natural gas is shown in the chart, Figure 1, following p. 2.

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chemical industry. In execution of the investment plans, the Satellites are relying heavily on aid from the USSR but also have found it necessary to obtain technical aid and equipment from the West. One major purchase from the West was technology and equipment for four polyethylene plants to be supplied by the UK to Czechoslovakia, East Germany, Poland, and Rumania.

Only Rumania is producing significant amounts of petrochemicals at present. Czechoslovakia, which reportedly is now receiving Soviet oil by pipeline and which has two petrochemical plants scheduled to start operation this year, presumably will soon initiate petrochemical production on a fairly large scale. East Germany and Hungary also may be able to start production of petrochemicals in the near future. It is doubtful that over-all plans for petrochemicals in the Satellites, which in some cases are projected as much as 5 or 6 years beyond current plan periods (which end in 1965), will be fulfilled on schedule. Nevertheless, the Satellite countries should make considerable progress by 1965 toward establishing a petrochemical base for a major part of their chemical industries.



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I. Introduction

In mid-1958, soon after the announcement of the high-priority program for chemicals in the Soviet Seven Year Plan (1959-65), Khrushchev made a visit to East Germany during which both he and Ulbricht, the East German Premier and First Secretary of the Socialist Unity (Communist) Party, delivered major speeches which contained the first indication that the European Satellites also would expand their chemical industries on a priority basis. Ulbricht, in particular, noted that this expansion would include, as a basic feature, the establishment of a petrochemical industry in the Satellites and that a pipeline would be laid from the USSR to bring Soviet oil to those Satellites that do not possess adequate domestic raw materials for such processing. The pipeline has thus been linked, from its inception, to the purpose of providing petrochemical raw materials, besides functioning as a source of raw materials for fuels, lubricants, and other petroleum products.

Early in 1962 the first major section of the pipeline was completed. Oil reportedly has started to flow to the new petrochemical center just outside Bratislava in Czechoslovakia, marking a major step toward realization of the goal of large-scale production of petrochemicals in the Satellites.

II. Significance of a Petrochemical Industry in the European Satellites

The Sino-Soviet Bloc has lagged well behind the West in establishing a petrochemical industry. In the USSR, production of petrochemicals did not begin on a significant scale until the mid-1950's, and production elsewhere in the Bloc has been almost nonexistent until very recently. In the US, on the other hand, large-scale production began in the 1930's and petrochemicals now account for about one-third of the volume of production of basic chemicals. Production also is well established in Western Europe and is expanding rapidly, and Japan, Australia, and several countries of Latin America and South Asia have begun production in this field.

It was decided to establish a petrochemical industry in the Satellites mainly because petrochemicals constitute the only means of providing in sufficient quantities and sufficiently cheaply the raw materials needed for the manufacture of the end products most stressed in the plans of the chemical industries of the various countries -- synthetic materials (rubber, fibers, and plastics) and chemical fertilizers. It was recognized that production of these products in the amounts called for in the plans would be prohibitively expensive if based on either coal or agricultural products, the alternative raw

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materials. In Poland it has been estimated that synthetic materials and fertilizers can be produced 30 to 40 percent more cheaply from petrochemicals than from coal, and Soviet Party Secretary Kozlov, in discussing the establishment of a petrochemical industry in East Germany, stated that the use of oil would "lower costs of products more than half." 1/* Factors responsible for the substantial savings anticipated in both operating and capital costs include the lower cost of producing and transporting petroleum and natural gas; the smaller number of steps involved in chemical processing, which lowers both the cost of installations and operating costs; increased possibilities of using less expensive, open-air construction; reduced requirements for electric power; and the higher productivity that can be achieved in large-scale, highly automated plants.**

The importance of petrochemicals in the plans of the chemical industries of the Satellites is indicated by the share of investments allocated to them during the current plan periods. In East Germany the largest project of the chemical industry under the Seven Year Plan (1959-65) is the petrochemical plant at Leuna, and the third largest -- which, nevertheless, is to account for investments equal to more than 10 percent of the total investments in the chemical industry during the Seven Year Plan -- is the refinery and petrochemical plant at Schwedt. 3/ In Poland, investments in the three large petrochemical plants are scheduled to be equal to about 50 percent of the total investments planned for the chemical industry under the current Five Year Plan (1961-65), although not all of the amount will be invested during the plan period. The petrochemical plant at Plock is the largest construction project of the chemical industry in Poland at present. 4/ In Hungary, nearly two-thirds of investments in the chemical industry during the current Five Year Plan (1961-65) will be devoted to expanding production of chemical fertilizers, plastics, and synthetic fibers, and inasmuch as most of this expansion will be on a petrochemical base, it may be assumed that a large share of investments is going directly or indirectly into the petrochemical industry. 5/

III. Production Goals

A. General

Although only Hungary and Rumania have published over-all goals for production of petrochemicals, all the Satellites have published

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** In East Germany it is estimated that productivity in the petrochemical industry will be at least 10 times productivity in the coal-chemical industry, an advantage of special importance in view of the expected decline in the East German labor force during the next few years. 2/

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targets for some individual products or other information indicating the importance of petrochemicals in the development of their chemical industries. The accompanying table,* for example, shows plans for production of nitrogen fertilizer and synthetic rubber in 1965 and the percentage of each to be produced on a petrochemical base, together with comparative production in 1960. The amount of nitrogen fertilizer to be made from petrochemicals in 1965 equals about 70 percent of the increase in output planned for the 5 years; more than 80 percent of the increment in output of synthetic rubber is to be based on petrochemicals.

B. Goals in Individual Countries

1. Albania

The goal for nitrogen fertilizer shown in the table is the only target that Albania has announced for petrochemical production. It is believed that this level of production is scheduled for 1965.

2. Bulgaria

Bulgaria has set goals for production of 60,000 tons** of ethylene and 20,000 tons of propylene by 1963-64. Planned production of 10,000 tons of polyethylene by 1964-65 will be based entirely on petroleum-derived ethylene. Bulgaria also plans to produce 30,000 tons of synthetic rubber on a petrochemical base by 1967. 6/

3. Czechoslovakia

Czechoslovakia, in addition to announcing goals of more than 100,000 tons of ethylene and more than 50,000 tons of propylene (presumably by 1965), has indicated that, whereas in 1958 the ratio of coal to petrochemicals as chemical raw materials was greater than 95 to 5, in 1965 the shares will be about equal, with petrochemicals slightly in the lead. Moreover, the demand for basic organic raw materials is expected to be about five times as large in 1965 as in 1958. 7/

4. East Germany

The petrochemical industry will be relatively less important in East Germany than in the other Satellites because of the magnitude of and the increases planned for the coal-chemical industry. East Germany has announced, however, that by 1965 all ethylene (100,000 tons, nearly three times current production), all propylene (16,000 tons), 90 percent of the xylols (about 28,000 of 31,000 tons), half

* The table follows on p. 6.

** Tonnages are given in metric tons throughout this report.

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Table

Production of Nitrogen Fertilizer and Synthetic Rubber in the European Satellites
1960 and Planned for 1965

Country	Nitrogen Fertilizer ^{a/}				Synthetic Rubber			
	1960		1965 Plan		1960		1965 Plan	
	Thousand Metric Tons	Percent from Petrochemicals	Thousand Metric Tons	Percent from Petrochemicals	Thousand Metric Tons	Percent from Petrochemicals	Thousand Metric Tons	Percent from Petrochemicals
Albania	0	0	23 ^{b/}	100	0	0	0	0
Bulgaria	84	0	267	0	0	0	30 ^{c/}	100
Czechoslovakia	140	0	300	33	1	0	55	98
East Germany	334	0	386	0	86	0	105	0
Hungary	57	0	160	85	0	0	Negl.	0
Poland	270	12	464	32	20	0	45	33
Rumania	19	80	280	98	0	0	50	100
Total	<u>904</u>	5	<u>1,880</u>	37	<u>107</u>	0	<u>285</u>	52

a. Nitrogen content.

b. Estimated; reported as "110,000 tons of ammonium nitrate."

c. For 1967.

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the phenol (about 25,000 of 50,000 tons), and 26 percent of the benzol (about 14,500 of 56,000 tons) will be produced from petroleum. All these products, except about 17 percent of the ethylene, were made entirely from coal in 1959. Production of naphthalene, ammonia, and acetylene will continue to be based on coal, however. 8/ The latter, produced via calcium carbide, forms the basis for the bulk of East German organic synthesis at present. It is considered economical in East Germany to continue and even expand production of carbide, because electric power, required in large quantities for its manufacture, is comparatively cheap in East Germany.

5. Hungary

Hungary has indicated that production of basic petrochemicals from oil is to reach 60,000 tons by 1965 but has not specified what products are covered by this figure. In addition, production of nitrogen fertilizer, which is to be 3-1/2 times as large in 1965 as in 1959, is to be based largely on natural gas. About 95 percent of the acetylene to be produced in 1965 is also to be obtained from natural gas, and polyvinyl chloride plastic based on acetylene is to account for more than one-third of all plastics produced in 1965 (about 12,000 of 33,000 tons). Petroleum-based polyethylene is to be produced at a rate of about 10,000 tons per year after 1966. 9/

6. Poland

In Poland, 30 percent of all production of plastics, including all polyethylene (10,000 tons), is to be based on petroleum by 1965, and an additional 21 percent (40,000 of 60,000 tons of polyvinyl chloride) is to be based on acetylene from natural gas. Production of synthetic phenol on a petrochemical base is also to start by that year, 10/ and part of the raw material for synthetic rubber is to be obtained from petroleum.

7. Rumania

Rumanian plans call for production of primary synthetic products* in 1965 to exceed 400,000 tons and for 93 percent of this amount to be derived from petrochemicals, compared with 57 percent of a total of less than 25,000 tons in 1959. Output of products based on methane in 1965 is to be 14 times and output of products based on petroleum 37 times the level of 1959. Petrochemicals are to provide the starting materials for 68 percent of all plastics and 77 percent of all synthetic fibers in 1965. (The output of these two groups of

* The products covered by this classification were not indicated in the Rumanian statistics.

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products is to increase by factors of 14 and 53, respectively, by that year.) Synthetic rubber, for which a target of 50,000 tons has been set for 1965, will be produced entirely from petrochemicals. Products based on petrochemicals will account for more than 22 percent of the gross output of the Rumanian chemical industry in 1965. 11/

IV. Supply of Raw Materials

A. Sources

The backbone of the petrochemical industry of the Satellites is the so-called "Friendship" pipeline being laid from the Soviet oil-fields near Kuybyshev to Czechoslovakia, Hungary, Poland, and East Germany (see the map, Figure 2*). This pipeline is a cooperative project of these four countries and the USSR. Although each country is laying the pipeline in its own territory, according to basic plans furnished by the USSR, there has been some division of labor in supplying components. East Germany, for example, is supplying pumps and a large amount of pipe** and also has furnished a credit of nearly 60 million (new) rubles*** to Poland to finance the section in Polish territory. Czechoslovakia is furnishing valves and Hungary communications equipment. Most of the pipe-laying equipment apparently is being loaned by the USSR. 12/

All production of petrochemicals in East Germany will depend on petroleum received through the pipeline. Each of the other three countries has at least one large plant scheduled to use raw material from this source but will also use other raw materials: Poland will receive natural gas as well as petroleum from the USSR, Hungary will receive natural gas from Rumania and will continue processing domestic petroleum and natural gas, and Czechoslovakia also plans to use domestic natural gas to supply one of its major petrochemical plants.†

Bulgaria also will rely on Soviet oil but will be supplied by tanker via the Black Sea. Later, domestic petroleum will supplement

* Following p. 8.

** Pipe also is being obtained from the Free World.

*** In new rubles established by the Soviet currency reform of 1 January 1961. A nominal rate of exchange based on the gold content of the respective currencies is 0.90 ruble to US \$1. This rate, however, should not be interpreted as an estimate of the equivalent dollar value of similar US goods or services.

† In general, Czechoslovakia plans to use natural gas to produce ammonia (for nitrogen fertilizer) and acetylene; to make olefins from petroleum-derived crude gasoline; and to continue producing aromatic hydrocarbons and phenols, as well as some acetylene, on a coal base. 13/

European Satellites: Locations of Petrochemical Plants

Figure 2



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supplies from the USSR. Bulgaria also possesses two deposits of natural gas, at least one of which could be used for producing petrochemicals.

Rumania will use its own abundant resources of both petroleum and natural gas for its developing petrochemical industry. Albania also has domestic resources of both petroleum and natural gas which can serve as raw material for its single scheduled petrochemical plant.

B. Amounts and Current Status

1. Petroleum

In spite of some reports of difficulties in the supply of materials and equipment, work on the "Friendship" pipeline apparently is proceeding steadily and not far behind schedule, although there is some indication that even if it is completed in 1963 as originally planned, it will not actually be in operation until 1964. The southern branch to Czechoslovakia, 700 kilometers (km) long (400 km in Czechoslovak territory), has been completed from Vlcie Hrdlo just outside Bratislava in western Czechoslovakia via Uzhgorod on the Soviet-Czechoslovak border to Brody in the Ukraine. It was put into operation in February 1962, even though the oil must be brought from the Soviet oilfields to Brody by rail. 14/

It has been reported that 1 million tons of oil will flow through this section of the pipeline in 1962. 15/ This figure apparently does not include amounts which will be diverted at Sahy to Hungary.* There is no indication of how much of the oil actually will be used for production of petrochemicals in either country. Any oil that goes to Hungary presumably will be used mainly for fuels, because the petrochemical plant at Szazhalombatta is still far from completion. Eventually Czechoslovakia is to receive 97 percent of its petroleum supplies through this pipeline 17/ and Hungary well over half.**

Work on the northern branch of the pipeline is proceeding in both directions from Plock in Poland. The shorter section to the Soviet border (290 km) presumably will be completed before the section to the East German border (390 km), although both sections are to be within 60 to 70 km of completion by the end of 1962.*** The section

* This branch line to Hungary, about 130 km long, reportedly was completed early in May 1962. 16/

** About 3 million tons, compared with an estimated amount of 2.2 million tons to be produced domestically. 18/

*** In April 1962, one-half of the total length of the Polish section was reported completed. 19/

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of the line across the bed of the Oder River, between Poland and East Germany, has already been laid, about 25 km downstream from Schwedt. It also has been reported that in the USSR the Volga crossing has been made, that the line has progressed "several hundred" kilometers westward from the oilfields, and that work is underway on the section of 450 km across Belorussia. 20/

In 1965 the four Satellite countries are to receive 15 million tons of crude oil through the pipeline, compared with the total of 4 million to 5 million tons received from the USSR by other shipping methods in 1959. By 1970 the amount is to reach 20 million to 22 million tons. 21/

2. Natural Gas

In addition to an existing pipeline which carries Soviet natural gas to Poland, another line is planned between Poland and the USSR. The new line, extending about 300 km from Dashava in L'vovskaya Oblast to Pulawy in Poland, is to carry 1 billion cubic meters (cu m) per year, whereas current contracts call for only 300 million cu m per year through the existing line during 1961-65. The Polish section of the new line, to be started in 1963, is scheduled for completion in 1965. 22/

A pipeline from Rumania to Hungary, 365 km long, has been in use since 1959 and is furnishing gas at the rate of nearly 200 million cu m per year, equivalent to about 60 percent of Hungarian domestic production in 1960 (342 million cu m). At present, Rumanian gas is being used in Hungary mainly to produce electric power, but it is planned to use these supplies in the future to produce petrochemicals. Plans call for Hungarian production of gas to reach 1.8 billion cu m in 1965, so that Rumanian gas will become relatively much less important to Hungary unless shipments are increased considerably. 23/

V. Production Centers*

A. Location and Products

The four Satellites which will receive Soviet oil through the "Friendship" pipeline are all building large petrochemical combines to process it. Three of these combines -- at Schwedt in East Germany, Bratislava in Czechoslovakia, and Szazhalombatta in Hungary -- are terminal points for the respective branches of the pipeline. The fourth -- at Plock in Poland -- is located on the line which is to supply East Germany.

* For locations of production centers, see the map, Figure 2, following p. 8, and for details on individual plants, see Appendix A.

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The plant at Bratislava is to produce both synthetic phenol and olefins and polyolefins. The combine at Schwedt is to start operation as a refinery, with some production of aromatics (benzol, toluol, and xylols).* The enterprise at Plock has plans for producing a broad range of products with emphasis on olefins and derivatives. The plant at Szazhalombatta is scheduled to be the main supplier of materials for the Hungarian plastics industry.

All four of these countries are also planning to build or expand other plants besides those located directly on the pipeline. Czechoslovakia has a second major plant under construction at Sal'a nad Vahom, which is to produce nitrogen fertilizer from natural gas, in addition to olefins and derivatives. An existing plant at Most-Zaluži, which currently produces chemicals primarily on the basis of coal, is to become a significant producer of petrochemicals by 1965.

East Germany is building a new plant at Leuna near Merseburg to produce phenol, caprolactam, ethylene, and polyethylene. A large new plant for producing synthetic fibers on a petrochemical base is being built at Guben, and capacity is being expanded at existing synthetic fiber plants at Premnitz, Schwarza, and Wolfen.

Hungary is expanding an existing oil refinery at Szony which is to produce petrochemicals and is building plants at Berente and Tiszapalkonya to produce plastics and nitrogen fertilizer from Rumanian natural gas. The plant at Berente, which is to produce polyvinyl chloride plastic, will use calcium carbide as raw material initially, converting to natural gas later. An existing plant at Kazincbarcika, which produces ammonia and nitrogen fertilizer from coke, is being expanded to twice its present capacity for fertilizer and is also to be converted to operate on natural gas.

Poland has another large plant at Pulawy for production of nitrogen fertilizer, and eventually plastics and synthetic fibers, from natural gas. An existing plant at Tarnow-Moscice, which produces nitrogen and plastics using natural gas as part of its raw materials, is being expanded.

Of the remaining Satellites, Albania and Bulgaria are planning only a single petrochemical plant apiece. The Bulgarian plant, an oil refinery located near the port city of Burgas, where Soviet oil can easily be received by tanker, is to produce ethylene, propylene, polyethylene, and eventually synthetic rubber. Bulgaria has mentioned

* Initially these products will account for only about 3 percent of total production; significant production of petrochemicals is not scheduled until later. 24/

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plans to build an additional plant to produce polyvinyl chloride plastic from acetylene, but the acetylene presumably will be obtained at least initially from calcium carbide. The Albanian plant, scheduled to produce nitrogen fertilizer, is to be built at Fier.

Rumania has the most widespread distribution of petrochemical plants of all the Satellites. Two major petrochemical centers using domestic petroleum are being developed at Onesti-Borzesti and in the Ploesti area; the plant at Brazi is to be the largest in the latter region. Plants to operate on natural gas are to be built at Craiova and Tirgu Mures. A number of existing smaller plants are being expanded. Petrochemical end products to be produced in Rumania include carbon black, detergents, insecticides, and herbicides as well as fertilizers, plastics, and synthetic fibers.

B. Status and Plans

Although the plant at Tarnow in Poland is using natural gas to make ammonia, methanol, and a few other products, and the refinery at Szony in Hungary may be producing some chemical intermediates from domestic petroleum, the only installations in the Satellites now producing petrochemicals in significant amounts are in Rumania. The first plant with a fairly large capacity for nitrogen fertilizer, 100,000 tons per year, was completed in 1960 at Fagaras, and another, which eventually is to have double that capacity, is scheduled to start partial operation in 1962 at Roznov. Several other Rumanian plants are operating on a limited scale, with a range of products including acetylene, acetone, formic and oxalic acids, formaldehyde, carbon black, detergents, methanol, carbon tetrachloride, and phenol, the latter in quantities sufficient to permit exports. One plant is producing synthetic fibers on a petrochemical base, and at least two are making small amounts of plastics. 25/

The large plants scheduled to be the mainstay of the Rumanian petrochemical industry are not far advanced, however. There is no evidence that construction has started on the two which are to be the largest producers of nitrogen fertilizer (Craiova and Tirgu Mures, with planned capacities of 400,000 and 500,000 tons per year, respectively), although both are scheduled for completion by 1965. The combine at Onesti also is scheduled to be completed by 1965. It may have started to produce caustic soda in 1961 as planned but probably is not yet producing petrochemicals. The plant at Brazi is reported to be in partial operation, but the products are not known. 26/

Czechoslovakia probably will become the second significant producer of petrochemicals among the Satellites, inasmuch as two of its plants, at Bratislava and Sal'a nad Vahom, are scheduled for at least

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partial operation in 1962, and Soviet oil reportedly is already being received by pipeline. By 1965 the plant at Sal'a nad Vahom is scheduled to produce about one-third of all nitrogen fertilizer to be made in Czechoslovakia. 27/

East Germany also may be ready to start producing petrochemicals on a significant scale by the end of 1962, if the first stage of the installation for producing ethylene at Leuna is completed on schedule. The Hungarian plant at Berente also is scheduled for completion in 1962, but its initial operation will be based on calcium carbide, not petrochemical raw materials. There is some indication, however, that the plant at Kazincbarcika may shift to operation on natural gas before the end of 1962. 28/

The remainder of the petrochemical capacity currently planned in Czechoslovakia is scheduled for completion by 1965. In East Germany, however, expansion of the combine at Schwedt is planned through 1970,* and in Hungary the refinery planned at Szazhalombatta is not scheduled for final completion until 1968. There is little indication as to whether or not construction of petrochemical installations is proceeding on schedule in these countries. Initial operation of the combine at Schwedt, however, has been postponed from 1963 to 1964. Several storage tanks have been completed at this combine and have been in use since September 1961, but it does not appear that the plant proper has been started yet. 30/

The petrochemical industry in Poland may be expected to augment its present limited production by 1964, when the refinery at Plock probably will start producing some chemical products from petroleum. Plans call for completion of the first stage of the combine at Plock in 1965 and of the final stage in 1971. The petrochemical installation to be built at Tarnow is scheduled for completion in 1967, and the plant at Pulawy, which has not yet been started, is supposed to have its first two stages operable by 1968. 31/

The first stage of the oil refinery near Burgas in Bulgaria is scheduled for completion in 1963, with production of polyethylene scheduled for 1964. It is not known whether or not construction of the Albanian fertilizer plant at Fier has been started, but the plant is listed among projects to be completed by 1965. 32/

* There have been rumors that this expansion would not take place but that additional refineries, of about the same size as the first stage at Schwedt, would be built at other locations. Whether or not these refineries, if built, would also produce petrochemicals has not been indicated. Official reports mention no refineries except at Schwedt. 29/

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VI. Sources of Technology and Equipment

A. Intra-Bloc Cooperation

Although most of the Satellites are building at least part of the equipment for their petrochemical installations themselves, all except Albania are receiving aid in some degree from the USSR. The USSR was scheduled to aid Albania, also, by supplying a plant for nitrogen fertilizer, but the aid was canceled as a result of the political rift between the two countries. Although Communist China presumably has now agreed to assist in building this plant, it is not certain whether the assistance includes technical aid or is limited to financial support.

Bulgaria is receiving Soviet technical aid for the petrochemical plant being built at Burgas, and the plant will be entirely equipped with Soviet machinery and instruments. Soviet data were furnished for the Czechoslovak plant at Bratislava. The USSR has furnished Hungary with process data and equipment for polyvinyl chloride, polyethylene, and nitrogen fertilizer. East Germany has received Soviet blueprints and data for the phenol plant being built at Leuna and for the refinery and petrochemical plant under construction at Schwedt. Rumania has received Soviet technical aid and equipment for several plants. East Germany and Rumania have also furnished equipment to each other. Poland is receiving equipment not only from the USSR but from Rumania, Czechoslovakia, and Hungary as well.

B. Procurement from Western Sources

In spite of the extent of Soviet aid and their own production and exchange of equipment, the Satellites are obtaining a considerable amount of petrochemical technology and equipment from Western countries. The most outstanding example of procurement in the West was the joint purchase by Poland, East Germany, Czechoslovakia, and Rumania of process data from the UK for building plants in all four countries for production of polyethylene. The plants are to be located at Leuna in East Germany, at Brazi in Rumania, at Blachownia Slaska in Poland, and probably at Bratislava in Czechoslovakia. All will be similar in size and design, because apparently only one set of documents is being prepared, each country paying about one-fourth of the costs. Poland has admitted that it could not have solved the technical problems without aid and also has noted that not one of the countries alone could have afforded the purchase price. The plants in Poland and Czechoslovakia are scheduled for completion in 1963. Dates for completion of the other plants have not been specified. Each plant will have a capacity of about 24,000 tons of polyethylene per year. 33/

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East Germany also is obtaining an ethylene plant from the UK and another from West Germany and is reported to be purchasing some equipment for the Schwedt combine from Western countries, the Netherlands for one. [redacted] part of the equipment for the combine being built at Plock is being produced by France, the UK, Italy, and Austria. Rumania has obtained a Belgian license for a process for producing acetylene from natural gas. 34/

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VII. Problems and Prospects

Problems faced by the European Satellites in developing their petrochemical industry differ little from those faced in developing the chemical industry in general. Progress in construction nearly always has been slower than planned, and procurement of equipment has been a constant bottleneck. East Germany is having particular difficulties with the latter problem since the decision of summer 1961 to make the East German economy immune to any actions which West Germany may take, or threaten to take, to interrupt interzonal trade. Corrosion-resistant materials for chemical equipment, especially stainless steels, have been procured largely from West Germany, and the necessity of finding other sources of supply undoubtedly has been one factor contributing to the admittedly inadequate performance of the segment of the East German metal-fabricating industry which makes chemical equipment. To the extent that East Germany is scheduled to furnish equipment to the other Satellites, delayed deliveries must be reflected in delays in completing new capacity for chemical production in the other countries.

The degree to which the Satellites succeed in achieving their goals for 1965 will be appreciably determined by the amount of technical aid and equipment they continue to obtain from the USSR and by the amount they receive from the West. If Western aid already contracted for should be withdrawn (which does not appear to be likely under present circumstances), the petrochemical industry of the Satellites would suffer a serious setback. If, on the other hand, the Satellites should succeed in obtaining additional technology and equipment from the West, lags in their own program might be more than compensated for. It is not unlikely that some further contracts will be signed with Western companies, but problems of cost and foreign exchange may limit the extent of procurement from the West.

The meager information available on the progress of construction and the procurement of technology and equipment points rather definitely toward a failure by the European Satellites to fulfill the plans for production of petrochemicals in 1965. On the other hand, it seems unlikely that any major segment of the program will be abandoned or significantly modified. It is expected, rather, that target dates will

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merely be extended. The petrochemical industry is sufficiently important to the development of the chemical industry of the Satellites -- and the chemical industry is sufficiently important to the development of industry as a whole -- to assure that a large effort will be devoted to pushing the petrochemical projects to completion, even though schedules may be delayed a year or two. Soviet interest in the petrochemical industry of the Satellites -- both as a market for Soviet oil and as a source of desired end products, especially plastics* -- may be expected to provide supplemental impetus for completing the planned projects.

Even if plans for the petrochemical industry in the Satellites through 1965 are not completely fulfilled, there still will be a substantial increment in production of several important chemical products and a major step toward establishing a modern base for a major part of the chemical industry. It should be noted, however, that although most of the increase in production of synthetic materials and nitrogen fertilizers will come from petrochemical sources, Czechoslovakia, Hungary, and East Germany all emphasize that the coal base is by no means to be abandoned; East Germany, in fact, expects to expand capacity for calcium carbide by more than 40 percent by 1965, 35/ in order to provide additional raw materials for synthetics, while simultaneously establishing its petrochemical industry. Moreover, current production of petrochemicals in the Satellites is so small that even if all programs for expansion through 1965 should be completely realized, the area would still be lagging in this field in comparison with the West.

* East Germany in particular is expected to furnish plastics, especially polyvinyl chloride, to the USSR in significant amounts.

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APPENDIX A

PETROCHEMICAL PLANTS IN THE EUROPEAN SATELLITES

The accompanying tabulation lists plants producing primary or basic petrochemical products in the European Satellites. Plants which produce the major petrochemical end products (synthetic rubber, plastics, synthetic fibers, and fertilizers) thus are included only if they also produce primary or basic products. Other principal producers of the major petrochemical end products include the following: in Czechoslovakia, the plant being built at Kralupy nad Vltavou to produce synthetic rubber and plastics; in East Germany, plants for synthetic fibers being built or expanded at Guben, Premnitz, Schwarza, and Wolfen; in Hungary, the plant at Nyergesujfalu which produces Danulon (nylon); and in Poland, three synthetic fiber plants at Gorzow, Lodz, and Torun and the chemical combine at Oswiecim, which will use petrochemicals from the plant at Plock for part of its production of synthetic rubber.

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Location	Name and/or Type of Installation	Status	Principal Products and Annual Output	Raw Materials	Remarks
Albania					
Fier	Nitrogen fertilizer plant.	Planned; completion scheduled for 1965.	Nitrogen fertilizers (ammonium nitrate) (110,000 tons).	Domestic natural gas and/or petroleum.	Presumably receiving aid from Communist China.
Bulgaria					
Burgas	Oil refinery and petrochemical plant.	Refinery scheduled for operation in 1963; production of polyethylene for 1964; plant for synthetic rubber to be built in 1964-67.	Ethylene (60,000 tons), propylene (2,000 tons), polyethylene (10,000 tons), synthetic rubber (30,000 tons), phenol, styrene, and synthetic alcohol.	Soviet oil (by tanker); probably domestic oil later, also.	Soviet aid in construction; all machinery and equipment from the USSR.
Czechoslovakia					
Bratislava	Slovnaft (petrochemical plant).	Initial operation scheduled for 1962; full operation in 1965.	Phenol, acetone (cumene process); ethylene, polyethylene; propylene (20,000 tons); polypropylene; and inorganic products.	Soviet oil (by pipeline).	Terminus of pipeline; probably site of polyethylene plant purchased from the UK; Soviet data used in construction.
Most-Zaluzi	Czechoslovak-Soviet Friendship Chemical Works (chemical plant and oil refinery).	Existing plant, operating primarily on the basis of coal; production of petrochemicals to begin to be significant by 1965.	Ammonia, methanol, aromatics; olefins and synthetic ethyl alcohol planned.	Coal, to be supplemented by Soviet oil	To produce enough synthetic ethyl alcohol from oil by 1963 to supply synthetic rubber plant at Kralupy nad Vltavou.
Sal'a nad Vahom	Duslo (petrochemical plant)	First stage to be completed by 1962, second by 1965.	Ammonia, nitrogen fertilizer* (100,000 tons), mixed fertilizer; acetylene, acetic acid, acetaldehyde; ethylene, vinyl acetate, and chloroprene.	Domestic natural gas.	Key project of the Five Year Plan; is to produce one-third of all Czechoslovak nitrogen fertilizer by 1965.
East Germany					
Leuna near Merseburg	Leuna II (petrochemical plant; will be a part of VEB Leuna-Werke "Walter Ulbricht")	Partial operation scheduled in 1962; completion in 1965.	Phenol (by cumene process) (42,000 tons), caprolactam (24,000 tons), ethylene (80,000 tons), polyethylene (38,000 tons), and polypropylene.	Initial source of feedstocks not known; presumably petroleum fractions eventually will be obtained from refinery at Schwedt (from Soviet oil).	Largest investment project of East German chemical industry under the Seven Year Plan. West Germany and the UK are furnishing technology and equipment; the USSR furnished blueprints for the cumene process.

* Calcium ammonium nitrate and urea.

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Location	Name and/or Type of Installation	Status	Principal Products and Annual Output	Raw Materials	Remarks
East Germany (Continued)					
Schwedt/Oder	Schwedt Oil Refinery	First stage to be in operation in 1964.	Initially, gasoline, diesel fuel, lubricants, and so on; additionally after 1965, aromatics and olefins.	Soviet oil (by pipeline).	Terminus of the northern branch of the pipeline; third largest investment project of the East German chemical industry under the Seven Year Plan; drawings, blueprints, and some equipment from the USSR; also some domestic and Western equipment.
Hungary					
Berente, near Kazincbarcika	Berente Chemical Works*	To be completed in 1962.	Polyvinyl chloride (6,000 tons initially, to expand to three to four times that amount later) and inorganic products.	Calcium carbide initially (for organic production), but shift to natural gas later (presumably from Rumania).	Equipment obtained from France, West Germany, East Germany, and the USSR.
Kazincbarcika	Borsod Chemical Combine	Existing plant being expanded; to operate on natural gas by 1963.	Nitrogen fertilizer (calcium ammonium nitrate) (132,000 tons in 1960, 300,000 tons planned) and methyl alcohol (planned).	Coke at present; natural gas from Rumania later.	Using a Soviet process and some Soviet equipment for expansion; also some domestic equipment.
Szazhalombatta	Oil refinery	Planned; completion scheduled for 1968.	Raw materials for plastics.	Petroleum from the USSR.	Terminus of the Hungarian branch of the pipeline; will be the main supplier of several materials for plastics.
Szony	Szony Oil Refinery	Existing plant being expanded.	"Gas for the organic chemical industry."	Hungarian petroleum at present; will receive supplemental supplies by pipeline.	

* This plant may be a part of the Borsod Chemical Combine in Kazincbarcika.

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Location	Name and/or Type of Installation	Status	Principal Products and Annual* Output	Raw Materials	Remarks
Hungary (Continued)					
Tiszapalkonya	Tisza Region Chemical Combine	Scheduled to start operation in 1963-64; polyethylene plant to be at full capacity by 1966.	Ammonia (100,000 tons), nitrogen fertilizer (ammonium nitrate) (350,000 tons**), urea (10,000 tons), and polyethylene (10,000 tons); synthetic resins for paint in production now.	Natural gas from Rumania and/or low-octane benzine produced domestically.	Technology and equipment from the USSR, including plant for polyethylene.
Poland					
Elachownia Slaska, near Kedzierzyn	Coke-Chemical Plant	Existing plant being expanded and partly converted to petrochemical raw materials; petrochemical processing to start by 1963.	Aromatics from coal at present; later ethylene, ethyl benzol, polyethylene (16,000 tons in first stage), and polyester fibers.	Coal at present; later, light petroleum fractions also, presumably from Soviet oil.	Steam pyrolysis process obtained from Czechoslovakia and polyethylene plant from the UK.
Plock	Mazowsze Refinery and Petrochemical Combine	Partial operation to start 1964; completion of first stage scheduled for 1965, final stage 1971.	Phenol (40,000 tons), ethylene oxide (10,000 tons, later to double), butadiene, synthetic rubber (30,000 tons), propylene and polypropylene, xylol (3,100 tons in 1964, 6,000 tons in 1970), dimethyl terephthalate, nitrogen fertilizer, urea, glycerine and glycols, detergents, synthetic resins, and inorganic products.	Soviet oil by pipeline.	Many installations designed in Poland, but equipment also obtained from the USSR, Rumania, Hungary, Czechoslovakia, France, Italy, Austria, and the UK.
Pulawy	Pulawy Nitrogen Plant	Initial production expected in 1965, but construction not yet started; two stages to be completed by 1968 and a third at an unspecified later date.	Nitrogen fertilizer (including urea) (340,000 tons by 1968), ammonia (1,350 tons per day by 1968), and polyvinyl chloride (70,000 tons by 1965).	Soviet natural gas by pipeline.	Much equipment to come from Czechoslovakia.

* Unless otherwise indicated.

** This figure appears to be high in view of the amount of ammonia to be produced. A figure of 300,000 tons per year has also been reported.

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Location	Name and/or Type of Installation	Status	Principal Products and Annual* Output	Raw Materials	Remarks
Poland (Continued)					
Tarnow-Moscice	Feliks Dzierzynski Nitrogen Plant	Existing plant being expanded and partly converted to operate on natural gas; expansion to be completed by 1967.	Ammonia (present production of 300 tons per day to treble by 1965**), nitrogen fertilizer (including urea, 300 tons per day by 1962), methanol, vinyl chloride (80,000 tons planned), acrylonitrile (12,000 tons planned), caprolactam (8,000 tons planned), and inorganic products.	Domestic natural gas for all new products.	Some new installations designed domestically; license and know-how for partial oxidation of methane obtained from Montecatini in Italy; in 1960, processes were being sought for acrylonitrile and urea (those available in Poland and East Germany were considered to be unsatisfactory).
Rumania					
Brazi	Petrochemical Plant No. 2	Under construction, but in partial operation.	Acetone, methyl-ethyl ketone, polyethylene, and synthetic resins.	Domestic petroleum.	To be the main petrochemical plant in the Floesti area; equipment received from the USSR, East Germany, France, and the UK (polyethylene plant).
Buciumeni	Sometimes referred to as "Acetylene Plant No. 2"	Producing on pilot-plant scale (since 1955).	Acetylene and acetone.	Domestic natural gas.	Joint Hungarian-Rumanian project; some equipment from East Germany.
Copsa-Mica	Nicolae Teclu Plant	Existing plant.	Formic and oxalic acids, formaldehyde, methyl methacrylate (Plexiglas), and carbon black.	Domestic natural gas.	Received technical aid from the USSR for producing carbon black and from Chimigaz Institute in Medias for both carbon black and Plexiglas.
Craiova	Petrochemical Combine	Completion planned for 1965 but construction apparently not yet started.	Nitrogen fertilizer (400,000 tons), butanol (20,000 tons), plastics (unspecified), and synthetic and cellulosic fibers.	Domestic natural gas.	No indication of outside aid; completion by 1965 doubtful.

* Unless otherwise indicated.

** All increases presumably will be based on natural gas; it is not known whether existing installations will be converted.

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Location	Name and/or Type of Installation	Status	Principal Products and Annual Output	Raw Materials	Remarks
Rumania (Continued)					
Fagaras	Chemical Combine No. 1	Existing plant.	Nitrogen fertilizer (mainly ammonium nitrate, more than 100,000 tons), phenol, and bakelite.	Domestic natural gas and petroleum fractions.	Produced nitrogen fertilizer on a small scale before 1960, when new plant for ammonium nitrate was completed; equipment from the USSR for producing fertilizer and phenol.
Onesti-Borzesti	Petrochemical Combine	Scheduled to produce caustic soda in 1961 and to operate as a petrochemical combine by 1965.	Phenol (18,000 tons), acetone (11,000 tons), polyvinyl chloride (36,000 tons), synthetic rubber (50,000 tons), DDT (3,500 tons), herbicides (1,000 tons), tricresyl phosphate, and inorganic products.	Domestic petroleum and cracking gases.	Equipment and technical aid from the USSR.
Floesti	Petrochim Plant (refinery and petrochemical plant)	Existing plant.	Detergents and other unspecified products.	Domestic petroleum.	Producing on a small scale.
Risnov	Chemical plant	Existing plant.	Acetylene, acetic acid, and polyvinyl acetate.	Domestic natural gas.	Producing acetylene and polyvinyl acetate since 1960 (small scale); equipment from East Germany and domestic sources.
Roznov	Nitrogen Fertilizer Combine	Originally scheduled to produce dilute nitric acid and urea in 1961, but start of operations postponed to 1962.	Ammonia (100,000 tons), nitrogen fertilizer (ammonium nitrate) (210,000 tons), and urea.	Domestic natural gas.	Soviet documentation and equipment; urea to be used at first to make plastics, later for fertilizer.
Savinesti	Synthetic Fiber Plant	Existing plant scheduled for expansion.	Relon (nylon) fiber (800 tons), relon filament (500 tons), and rolan (orlon) fiber (200 tons).	Domestic petroleum and natural gas.	Total production of fibers to be 13,000 tons in 1965, increase consisting mainly of rolan; relon tire cord also to be made; plant believed to be built largely with Western aid.
Tirgoviste	Refinery and petrochemical plant	Existing plant.	Naphthenic acid for paints and lacquers.	Domestic petroleum	

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Location	Name and/or Type of Installation	Status	Principal Products and Annual Output	Raw Materials	Remarks
Rumania (Continued)					
Tirgu Mures	Petrochemical combine	Completion scheduled for 1965, but construction apparently not yet started.	Ammonia (100,000 tons), nitrogen fertilizer (including urea) (500,000 tons), and plastics and synthetic fibers (unspecified).	Domestic natural gas.	Probably will receive technical aid from the USSR.
Tirnaveni	Karl Marx Chemical Combine	Existing plant.	Ammonia and ammonium chloride, polyvinyl chloride (limited production), and inorganic products.	Coal and natural gas.	Oldest chemical plant in Rumania; not a significant producer of petrochemicals, but uses natural gas to make ammonia and derivatives; polyvinyl chloride probably made from coal (via calcium carbide).
Turda	Turda Chemical Plant	Existing plant.	Carbon tetrachloride, polyvinyl chloride (5,500 tons), DDT, and inorganic products.	Domestic natural gas for carbon tetrachloride and possibly other products.	Production of polyvinyl chloride and carbon tetrachloride began in 1959; petrochemical production still limited.
Victoria	Chemical Combine (formerly "I.V. Stalin Chemical Combine")	Existing plant being expanded.	Ammonia and derivatives, including nitrogen fertilizer (ammonium nitrate) and urea; plastics (aminoplasts), methanol, formaldehyde, and inorganic products.	Domestic natural gas.	Ammonia and nitrogen fertilizer produced now on small scale; production to be increased by 1965; production of methanol and formaldehyde from natural gas started in 1960-61; ammonium carbonate supplied to the fiber plant at Savinesti.

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